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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/788,053	02/16/2001	Jason Shepherd	SD6533/S93794	4160

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EXAMINER

HOGAN, MARY C

ART UNIT	PAPER NUMBER
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2123

DATE MAILED: 08/13/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/788,053

Applicant(s)

SHEPHERD ET AL.

Examiner

Mary C Hogan

Art Unit

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 2/16/01.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-22 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-22 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 16 February 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date 2/16/01.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

1. This application has been examined.
2. **Claims 1-22** have been examined and rejected.

Specification

3. The disclosure is objected to because of the following informalities. Appropriate correction is required.
4. **Page 7, line 14** is missing a period at the end of the sentence.
5. **Page 7, line 18**, "3.2" should be removed from the title of this section.
6. The abstract of the disclosure is objected to because page 1, line 3: "be they" is grammatically incorrect. Correction is required. See MPEP § 608.01(b).

Claim Rejections - 35 USC § 112

7. The following is a quotation of the **first paragraph of 35 U.S.C. 112**:
The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.
8. **Claims 4-11, 15-22** are rejected under **35 U.S.C. 112, first paragraph**, as containing subject matter which was not described in the specification in such a way as to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention. The specification broadly refers to the following: determining the boundary of boundary surface, determining a 1-dimensional mesh at least twice as fine as the first trunk mesh, identifying pairs of nodes, moving a node from each pair to boundary, highest quality mesh elements, determining which node of each pair is closest to the boundary, and determining if the boundary spans the diagonal. However, the specification does not provide any substantive detail, other than broad reference, to these concepts in such a manner to enable one skilled in the art to which it pertains, or with which it is most nearly connected, to make and/or use the invention.
9. The following is a quotation of the **second paragraph of 35 U.S.C. 112**:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

10. **Claims 1-22** are rejected under 35 U.S.C. 112, **second paragraph**, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

11. **Claims 1 and 12** recite "adjusting a portion of the first mesh *proximal* the boundary surface between the trunk and branch". The word "proximal" makes it unclear as to whether the second mesh is actually located *on* the first mesh or simply *near* the first mesh, rendering the claim vague and indefinite. Further, the claims recite "substantially conform". It is unclear from the claim and specification what "substantially conform" means, rendering the claim vague and indefinite.

12. **Claims 4 and 15** recite "at least twice as fine". The specification or claims do not provide an adequate description as to what "twice as fine" means rendering the claim vague and indefinite.

Claim Interpretation

13. As to **Claims 1 and 12**, it was determined that second trunk mesh refers to an interface surface located between the trunk mesh and the branch mesh, as referred to in the **specification, page 4, line 12 and Figure 1** as the "graft surface".

14. **Claims 4 and 15** recite "determining a 1-dimensional mesh" along said boundary, however, the specification does not describe this 1-dimensional mesh along the boundary and how it is determined. Therefore, it was concluded that this claim refers to re-defining the mesh of the interface after the boundary is determined.

15. As to **Claims 5 and 16**, it is unclear as to what "highest quality mesh elements" are and the specification does not give insight into how to determine what is a high quality mesh element. In reading the prior art of record, specifically, Blacker, (Blacker, Ted, "The Cooper Tool", Proceedings of the 5th International Meshing Roundtable 96, pages 13-29, October 1996) herein referred to as **Blacker**, it was determined that determining which node of each pair would produce the highest quality mesh elements were directed to moving nodes that would maintain the overall shape and quality of the mesh (**page 25, last sentence**).

16. As to **Claims 7 and 18**, it is unclear from the claims and specification how it is determined if the boundary spans the diagonal of any element of the second trunk mesh after moving nodes to the boundary, and if so, then moving one of the other nodes of said element to

the boundary. It was determined that since this claim is discussed in the specification under the topic of "Smoothing the Mesh to the Loop" that these claims are directed to a smoothing process.

Claim Rejections - 35 USC § 102

17. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in a patent granted on an application for patent by another filed in the United States before the invention thereof by the applicant for patent, or on an international application by another who has fulfilled the requirements of paragraphs (1), (2), and (4) of section 371(c) of this title before the invention thereof by the applicant for patent.

18. **Claims 1,4,6,12,15 and 17** are rejected under 35 U.S.C. 102(e) as being anticipated by Dohrmann et al (U.S. Patent Number 6,560,570), herein referred to as **Dohrmann**.

19. As to **Claims 1 and 12**, **Dohrmann** teaches: a method of generating a mesh representation of a region characterized by a trunk and a branch thereon, comprising: a) Determining a first trunk mesh (**column 3, lines 18-19, "first mesh" or "master mesh"**); b) Determining a second trunk mesh by adjusting the portion of the first mesh proximal the boundary surface between the trunk and the branch to substantially conform thereto (**column 3, lines 20-22 "interface surface"**); and c) Determining a branch mesh from the portion of the second mesh within said boundary surface and the geometry of the branch (**column 3, line 19, 24-26 "second mesh" or "slave mesh"**).

20. As to **Claims 4 and 15**, **Dohrmann** teaches: determining a second trunk mesh comprises: a) Determining the boundary of said boundary surface (**column 7, lines 16-18**); b) Determining a 1-dimensional mesh at least twice as fine as the first trunk mesh along said boundary (**Claim 1, part b**, wherein the slave interface is re-defined); c) Identifying pairs of nodes of the first trunk mesh defining intersections of the 1-dimensional mesh and the first trunk mesh (**column 6, lines 45-46**); d) Moving a node from each pair to said boundary (**column 6, lines 54-56, column 7, lines 18-23** where nodes on the slave surface are moved to a point on the master surface which make up the new boundary, F_m).

21. As to **Claims 6 and 17**, **Dohrmann** teaches moving a node comprises determining which node of each pair is closest to the boundary, and moving that node (**column 6, lines 51-56**,

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column 7, lines 18-23 wherein a node on the slave surface is matched with a node on the master surface (constituting a "pair") and that node on the slave surface is mapped to that node on the master surface based on a "minimum distance criterion", therefore moving one node of the pair to the to the boundary F_m).

Claim Rejections - 35 USC § 103

22. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

23. The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

24. **Claims 2,3,13 and 14** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Dohrmann** as applied to **Claims 1 and 12** above, and further in view of **Staten et al** (**Staten et al**, "BMSweep: Locating Interior Nodes During Sweeping", Proceedings of the 7th International Roundtable 98, pages 7-18, October 1998), herein referred to as **Staten**, and Applicants Own Admission, herein referred to as **AOA**.

25. As to **Claims 2,3,13 and 14**, **Dohrmann** teaches determining a first trunk mesh (**column 3, lines 18-19**) and a branch mesh (**column 3, line 19, 24-26**).

26. **Dohrmann** does not expressly teach the trunk and branch meshes comprising a 2 1/2-dimensional region, and wherein determining a first trunk mesh and branch mesh comprises sweeping the volume of the trunk and branch.

27. **Staten** teaches sweeping as a method of meshing 2 1/2-dimensional volumes with an all hex mesh since hexahedral elements are often preferred over tetrahedral elements for use in finite element analysis (**page 7, section 2.0, paragraph 1**). Further, **Staten** teaches that three dimensional volumes can be swept after being decomposed into 2 1/2 dimensional volumes (**page 7, abstract**).

28. Further, **AOA** states that the trunks are meshed with sweeping algorithms (**specification, page 7, lines 1-2**) and that branches are subvolumes of the trunk that are sweepable (**specification, page 6, lines 15-16, page 10, lines 5-9**).

29. It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the sweeping method as taught in **Staten** to determine the trunk and branch meshes as taught in **Dohrmann** since sweeping is a method of meshing 2 1/2-dimensional volumes with an all hex mesh and hexahedral elements are often preferred over tetrahedral elements for use in finite element analysis (**page 7, section 2.0, paragraph 1**).

30. **Claims 5 and 16** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Dohrmann** as applied to **Claims 1 and 12** above, and further in view of **Blacker**.

31. As to **Claims 5 and 16**, **Dohrmann** teaches moving a node from each pair to said boundary (**column 6, lines 54-56, column 7, lines 18-23**).

32. **Dohrmann** does not expressly teach moving a node comprises determining which node of each pair will, if moved, produce the highest quality mesh elements, and moving that node.

33. **Blacker** teaches projecting meshes onto a target surface in such a way that the overall shape and quality of the mesh is maintained even for drastic distortion in geometry (**page 25, last sentence-page 26, first sentence**).

34. It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the moving a node from each pair to said boundary as taught in **Dohrmann** to include moving a node that will produce the highest quality mesh elements since this will maintain the overall shape and quality of the mesh as taught in **Blacker** (**page 25, last sentence-page 26, first sentence**).

35. **Claims 7,8,9,11,18,19,20, and 22** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Dohrmann** as applied to **Claims 1 and 12** above, and further in view of White ("Automatic, Quadrilateral and Hexahedral Meshing of Pseudo-Cartesian Geometries using

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Virtual Decomposition”, Master’s Thesis, Brigham Young University, August 1996), herein referred to as **White**.

36. As to **Claims 7,8,9,11,18,19,20, and 22**, **Dohrmann** teaches determining a second trunk mesh (**column 3, lines 20-22 “interface surface”**) and moving nodes to the boundary (**column 6, lines 54-56, column 7, lines 18-23**).

37. **Dohrmann** does not expressly teach smoothing the first trunk mesh inside, outside or beneath the boundary or if the boundary spans the diagonal, moving one of the other nodes of said element to the boundary.

38. **White** teaches that a resulting quadrilateral/hexahedral mesh can be smoothed to eliminate the “sharpness” of the decomposition or to increase the conformity of the mesh to the original geometry (**page 8, lines 10-12**).

39. It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the step of determining a second trunk mesh as taught in **Dohrmann** to include smoothing the first trunk mesh inside, outside or beneath the boundary or if the boundary spans the diagonal, moving one of the other nodes of said element to the boundary, in order to eliminate “sharpness” of the decomposition and to increase the conformity of the mesh to the original geometry as taught in **White (page 8, lines 10-12)**.

40. **Claims 10 and 21** are rejected under 35 U.S.C. 103(a) as being unpatentable over **Dohrmann** as applied to **Claims 1 and 12** above, and further in view of **Mitchell et al** (**Mitchell et al, “Pillowing Doublets: Refining a Mesh to Ensure That Faces Share at Most One Edge, on the web at endo.sandia.gov/~samitch/pillowing-doublets.pdf**), herein referred to as **Mitchell and AOA**.

41. As to **Claims 10 and 21**, **Dohrmann** teaches determining a second trunk mesh (**column 3, lines 20-22 “interface surface”**) and moving nodes to the boundary (**column 6, lines 54-56, column 7, lines 18-23**).

42. **Dohrmann** does not expressly teach adding a pillow of mesh elements directly inside the boundary.

43. **Mitchell** teaches adding a pillow of mesh elements as a method to eliminate poor quality that will occur when two quadrilateral faces share two edges wherein it is necessary to change the local connectivity of the mesh through refinement (**page 1, paragraph 4 and page 3, sentences 4 and 8**).

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44. Further, AOA references **Mitchell** as stated above when stating that an STC sheet passes behind the first layer of hexes in the trunk creating a pillow of new hexes inside the loop (specification, page 9, lines 9-15).

45. It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the step of determining the second trunk mesh as taught in **Dohrmann** to include adding a pillow of mesh elements directly inside the boundary to eliminate poor quality that will occur when two quadrilateral faces share two edges as taught in **Mitchell**.

Conclusion

46. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mary C Hogan whose telephone number is 703-305-7838. The examiner can normally be reached on 7:30AM-5PM Monday-Friday. If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Kevin Teska can be reached on 703-305-9704. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Mary C Hogan

Examiner

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PATENT EXAMINER